NEW MEXICO OZONE ATTAINMENT INITIATIVE

Sensitivity of 2028 Ozone Projections to Current Year Ozone Design Values and Preliminary Draft Air Quality Technical Support Document

Marco Rodriguez, Pradeepa Vennam, Jung Chien, John Grant, Tejas Shah and Ralph Morris, Ramboll

Tom Moore and Mary Uhl, WESTAR

NM OAI Study Webinar

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SENSITIVITY OF 2028 OZONE PROJECTIONS TO DVC & AQTSD

01 Summary of 2028 Base and O&G Control Strategy Ozone Design Value Projections following EPA Guidance (from Feb 24, 2021)

02 Sensitivity of 2028 Ozone Projections to Current Year Ozone Design Values ($DVC_{2015\text{-}2019}$ and $DV_{2017\text{-}2019}$)

03 Preliminary Draft Air Quality Technical Support Document (AQTSD)

04 Status of 2028 O&G Control Strategy Source Sector APCA Ozone Source Apportionment Modeling

05 Status of 2028 O&G Control Strategy VOC/NOx Sensitivity OSAT Ozone Source Apportionment Modeling

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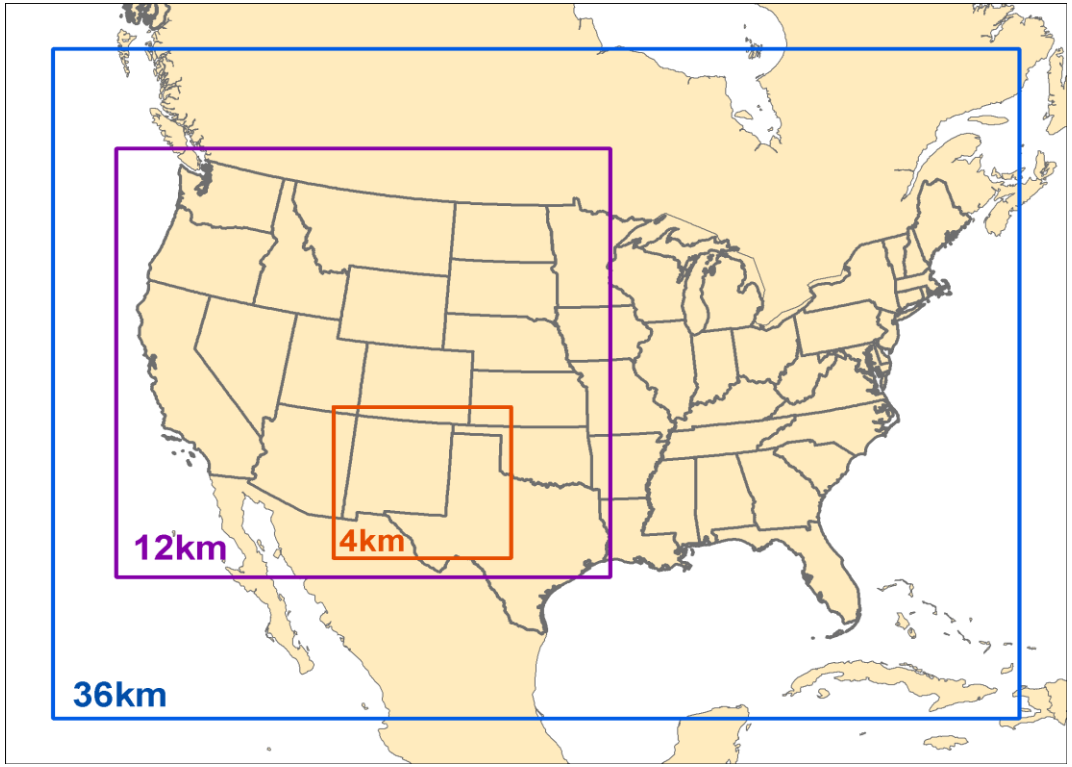
CAMX 2014 NM OAI STUDY MODEL CONFIGURATION

- Episode: May-August 2014
  - 16-day spin-up before first high ozone day in NM
    - 68 ppb on May 17
- 36/12/4-km Modeling Domains
  - 36/12-km domains same as WRAP Regional Haze
  - New 4-km New Mexico domain
- Boundary Conditions (BC) WRAP 2014 GEOS-Chem
- Four Meteorological Diagnostic Sensitivity tests
  - Selected WRF/NAM with Kv=CMAQ
- WRAP 2014v2 base year emissions
  - EPA NEI2014v2 w/ western state updates
- WRAP 2028OTBa2 for future year w/ 2014 actual fires and new 2028 NM O&G



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FUTURE YEAR OZONE DESIGN PROJECTION APPROACH

- EPA's Ozone Modeling Guidance (2018) recommends making future year ozone Design Value (DVF) projections using the relative change in modeling results between the base (2014) and future (2028) years to scale the current year ozone design value (DVC)
  - The model derived scaling factors are called Relative Response Factors (RRFs) and are the ratio of the future to current year CAMx modeling results averaged across the 10 highest modeled MDA8 ozone days > 60 ppb in the current (2014) year base case near the monitor:

$$RRF = \sum MDA8\ Ozone_{2028} / \sum MDA8\ Ozone_{2014}$$

$$DVF = RRF \times DVC$$

  - By "near the monitor," the maximum 2014 modeled MDA8 ozone within a 3x3 array of 4-km grid cells centered on the monitor from the 2014 is used
  - If there are not 10 modeled MDA8 ozone days in the 2014 base case > 60 ppb for the RRFs, then you can use less than 10 days, but EPA guidance recommends there be at least 5 days
  - EPA recommends that the observed current year design value (DVC) be based on the average of 3 years of ozone DVs over 5-years centered on the base modeling year (2014):

$$DVC_{2012\text{-}2016} = 1/3 \times (DV_{2012\text{-}2014} + DV_{2013\text{-}2015} + DV_{2014\text{-}2016})$$

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FUTURE YEAR OZONE DESIGN PROJECTION APPROACH

- EPA has codified their recommended future year ozone DVF projection technique in the Software for Modeled Attainment Test (SMAT)
- SMAT was applied using default settings, with one exception, and the 2014v2 and 2028 Base Case and 2028 O&G Control Strategy CAMx modeling results to obtain projected 2028 ozone DVF projections:
  - Use 3x3 array of 4-km cells centered on monitor for "near the monitor"
  - Use 10 days for RRFs with CAMx 2014 MDA8 ozone > 60 ppb
    - If less than 10 days with MDA8 ozone > 60 ppb use 4 days minimum (exception)
    - Default minimum number of days is 5, needed to relax to pick up Hobbs monitor in Lea County
  - Use current year design value based on average of 3 DVs centered on 2014
    - $DVC_{2012\text{-}2016}$
- SMAT Unmonitored Area Analysis (UAA) to obtain 2028 ozone DVF projections throughout 4-km New Mexico modeling domain
  - Recommend use spatial interpolation of monitoring site DVC without using modeled concentration gradients

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PROJECTED 2028 OZONE DVFS FOLLOWING EPA GUIDANCE

- Two sites have current year $DVC_{2012-2016}$ above the 2015 ozone NAAQS:
  - Desert View = 72.0 ppb
  - Santa Teresa = 71.3 ppb
- Using EPA guidance, all sites have 2028 ozone DVF below NAAQS
- 2028 O&G Control Strategy reduces 2028 ozone DVF by:
  - -0.3 to -1.5 ppb North NM Sites
  - -0.2 to -0.5 ppb Bernalillo County
  - -0.1 to -0.3 ppb South NM Sites

AQS_ID	2012-16	Projected 2028 DVF			Site Name	State
	DVC (ppb)	Base (ppb)	Cntl (ppb)	Cntl - Base		
Northern New Mexico						
350390026	64.0	60.8	60.0	-0.8	Coyote Ranger District	NM
350431001	64.0	58.4	58.1	-0.3	Bernalillo (E Avenida)	NM
350450009	64.3	61.0	60.2	-0.8	Bloomfield	NM
350450018	67.0	64.8	63.3	-1.5	Navajo Lake	NM
350451005	63.7	60.8	59.6	-1.2	Substation	NM
350490021	64.3	60.6	60.4	-0.2	Santa Fe Airport	NM
Bernalillo County						
350010023	66.3	60.9	60.7	-0.2	Del Norte HS	NM
350010024	68.0	62.3	62.0	-0.3	South East Heights	NM
350010029	66.0	61.0	60.5	-0.5	South Valley	NM
350010032	67.0	62.6	62.1	-0.5	Westside	NM
350011012	65.0	59.1	58.8	-0.3	Foothills	NM
Southern New Mexico						
350130008	66.3	60.0	59.8	-0.2	La Union	NM
350130017	67.0	61.9	61.8	-0.1	Sunland Park City Yard	NM
350130020	67.0	62.3	62.2	-0.1	Chaparral	NM
350130021	72.0	67.0	66.8	-0.2	Desert View	NM
350130022	71.3	66.1	66.0	-0.1	Santa Teresa	NM
350130023	65.0	60.3	60.2	-0.1	Solano	NM
350151005	69.0	66.7	66.4	-0.3	Carlsbad	NM
350171003	62.0	59.0	58.9	-0.1	Chino Copper Smelter	NM
350250008	66.0	64.0	63.3	-0.7	Hobbs Jefferson	NM
350290003	66.0	62.7	62.5	-0.2	Deming Airport	NM
350610008	66.3	62.2	62.0	-0.2	Los Lunas (Los Lentes)	NM

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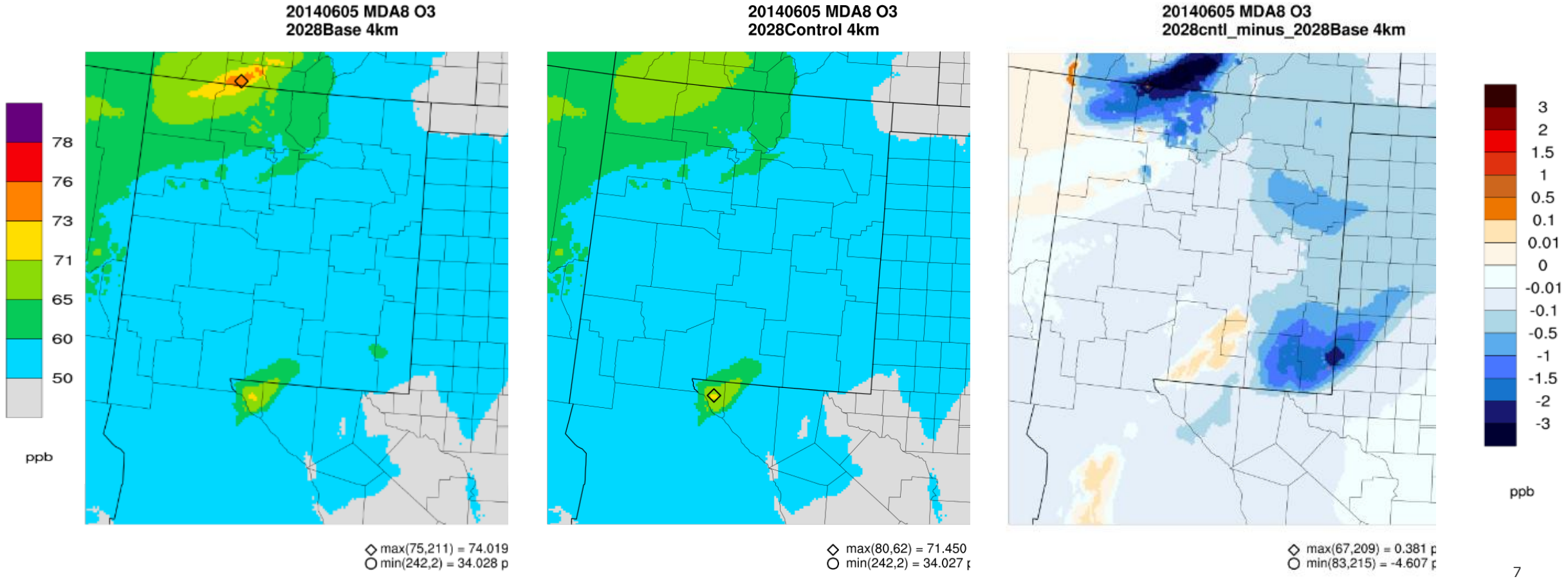
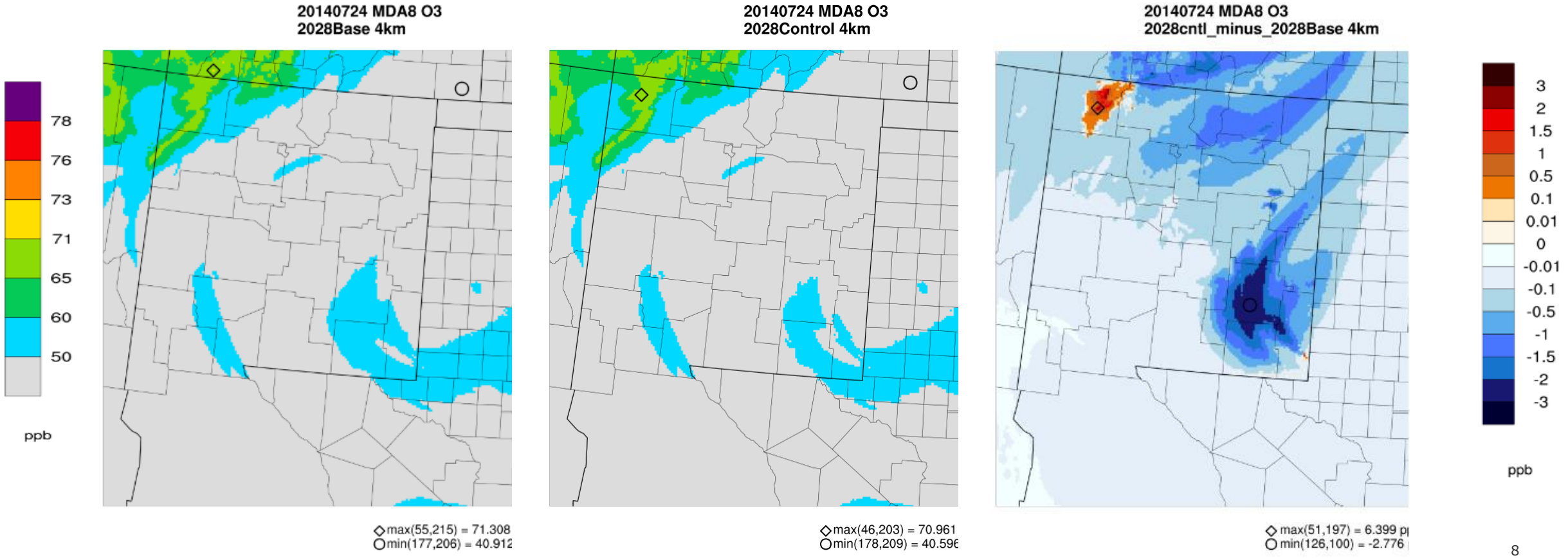
2028 BASE AND O&G CONTROL MDA8 OZONE ON JUNE 5, 2014

- Day with 2028 Base Case MDA8 ozone above 70 ppb 2015 ozone NAAQS in San Juan County that is reduced to below the NAAQS in 2028 O&G Control Strategy



2028 BASE AND O&G CONTROL MDA8 OZONE ON JULY 24, 2014

- Day in which NOx Disbenefits due to 2028 O&G Control Strategy is sufficient to increase a single 4-km grid cell in San Juan County that was below the ozone NAAQS in 2028 Base Case to barely above (71.0 ppb) the 2015 ozone NAAQS in 2028 O&G Control Strategy



INCREASING OZONE AT NEW MEXICO SITES

- More recent years have higher ozone DVs at some New Mexico sites:
  - Red > 75 ppb 2008 NAAQS
  - Yellow > 70 ppb 2015 NAAQS
  - Green > 67 ppb (95th percentile)
- Latest 2017-2019 ozone design value ($DV_{2017-2019}$) has 6 sites that exceed the 2015 ozone NAAQS:
  - Carlsbad = 79 ppb
  - Desert View = 77 ppb
  - Santa Teresa = 76 ppb
  - Chaparral = 73 ppb
  - Hobbs = 71 ppb
  - Foothills = 71 ppb

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Ozone Design Values 2010 to 2019

AQS Site ID	Local Site Name	County Name	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019
350010023	Del Norte HS	Bernalillo	0.064	0.066	0.068	0.070	0.068	0.066	0.065	0.067	0.070	0.070
350010024	SE Heights	Bernalillo	0.066	0.068	0.070	0.070	0.068					
350010027	Westside	Bernalillo	0.067	0.068	0.071	0.071						
350010029	South Valley	Bernalillo	0.066	0.067	0.069	0.070	0.067	0.066	0.065	0.065	0.066	0.067
350010032	Westside	Bernalillo			0.070	0.070	0.067					
350011012	Foothills	Bernalillo	0.068	0.070	0.074	0.072	0.067	0.064	0.064	0.067	0.069	0.071
350011013	North Valley	Bernalillo	0.067	0.068	0.069	0.069						
350130008	La Union	Dona Ana	0.064	0.062	0.065	0.067	0.067	0.066	0.066	0.068	0.068	0.070
350130017	Sunland Park	Dona Ana	0.064	0.065	0.068	0.067	0.067					
350130020	Chaparral	Dona Ana	0.066	0.067	0.067	0.069	0.068	0.067	0.066	0.068	0.071	0.073
350130021	Desert View	Dona Ana	0.070	0.069	0.072	0.072	0.072	0.072	0.072	0.072	0.074	0.077
350130022	Santa Teresa	Dona Ana	0.067	0.066	0.070	0.075	0.074	0.072	0.068	0.072	0.074	0.076
350130023	Solano	Dona Ana	0.063	0.063	0.065	0.065	0.065	0.065	0.065	0.066	0.067	0.070
350151005	Carlsbad City	Eddy	0.067	0.068	0.071	0.071	0.071	0.069	0.067	0.068	0.074	0.079
350153001	Carlsbad Caverns	Eddy									0.071	
350171003	Chino Copper	Grant	0.063	0.065	0.067	0.063	0.062					
350250008	Hobbs Jefferson	Lea	0.059	0.061	0.061	0.066	0.065	0.067	0.066	0.067	0.070	0.071
350290003	Deming Airport	Luna	0.057	0.058	0.064	0.067	0.066					
350390026	Coyote Ranger District	Rio Arriba							0.064	0.065	0.067	0.067
350431001	Bernallilo	Sandoval	0.060	0.061	0.061	0.063	0.063	0.065	0.064	0.065	0.068	0.068
350439004	Pueblo Of Jemez	Sandoval		0.062								
350450009	Bloomfield	San Juan	0.060	0.061	0.067	0.068	0.067	0.064	0.062	0.064	0.069	0.068
350450018	Navajo Lake	San Juan			0.071	0.071	0.068	0.067	0.066	0.068	0.070	0.069
350451005	Substation	San Juan	0.063	0.063	0.067	0.068	0.066	0.063	0.062	0.064	0.069	0.069
350490021	Santa Fe Airport	Santa Fe	0.063	0.062	0.065	0.066	0.066	0.064	0.063	0.063	0.066	0.066
350610008	Los Lunas	Valencia			0.067	0.070	0.069	0.066	0.064	0.065	0.067	0.068

2028 OZONE PROJECTIONS SENSITIVITY ANALYSIS TO DVC

- Given increased ozone concentrations in more recent years, a sensitivity analysis of the 2028 ozone projections to current year ozone design value (DVC) starting point for the projections was conducted
- 2028 ozone DVF projection sensitivity analysis was conducted using two alternative definitions of current year design value (DVC):
  - $DVC_{2015\text{-}2019} = (DV_{2015\text{-}2017} + DV_{2016\text{-}2018} + DV_{2017\text{-}2019}) / 3$
    - Consistent with EPA guidance to use average of 3-years of ozone DVs for DVC to modulate year-to-year variability, but centered on 2017 instead of 2014
  - $DV_{2017\text{-}2019}$ (the latest design value based on validated data)
- Still using CAMx 2014v2 and 2028 modeling results, so not accounting for changes in emissions from 2014 to 2017-2019 in 2028 ozone projections:
  - Where emissions went down (e.g., mobile source dominated), may understate 2028 ozone DVFs
  - Where emissions went up (e.g., Permian Basin O&G), may overstate 2028 ozone DVFs

2028 OZONE DVF SENSITIVITY TO DVC USING $DVC_{2015\text{-}2019}$

- Four monitoring sites have 2015-2019 current year $DVC_{2015\text{-}2019}$ greater than the 2015 ozone NAAQS:
  - Desert View = 74.3 ppb
  - Santa Teresa = 74.0 ppb
  - Carlsbad = 73.7 ppb
  - Carlsbad NP* = 71.0 ppb
- 2028 Base Case has one site with 2028 ozone DVF > NAAQS using $DVC_{2015\text{-}2019}$:
  - Carlsbad = 71.2 ppb
- 2028 O&G Control Strategy sufficient that all 2028 ozone DVFs are below the NAAQS when using $DVC_{2015\text{-}2019}$:
  - Carlsbad = 70.9 ppb

AQS_ID	2015-19	Projected 2028 DVF			Site Name	County
	DVC (ppb)	Base (ppb)	Cntl (ppb)	Cntl - Base		
350010023	69.0	63.4	63.1	-0.3	Del Norte HS	Bernalillo
350010029	66.0	61.0	60.5	-0.5	South Valley	Bernalillo
350011012	69.0	62.7	62.4	-0.3	Foothills	Bernalillo
350130008	68.7	62.1	62.0	-0.1	La Union	Dona Ana
350130020	70.7	65.7	65.7	0.0	Chaparral	Dona Ana
350130021	74.3	69.1	68.9	-0.2	Desert View	Dona Ana
350130022	74.0	68.6	68.5	-0.1	Santa Teresa	Dona Ana
350130023	67.7	62.9	62.7	-0.2	Solano	Dona Ana
350151005	73.7	71.2	70.9	-0.3	Carlsbad	Eddy
350153001	71.0	69.3	69.3	0.0	Carlsbad Caverns NP	Eddy
350250008	69.3	67.2	66.5	-0.7	Hobbs Jefferson	Lea
350390026	66.3	63.0	62.2	-0.8	Coyote Ranger Dist	Rio Arriba
350431001	67.0	61.2	60.9	-0.3	Bernalillo (E Avenida)	Sandoval
350450009	67.0	63.6	62.8	-0.8	Bloomfield	San Juan
350450018	69.0	66.7	65.2	-1.5	Navajo Lake	San Juan
350451005	67.3	64.2	62.9	-1.3	Substation	San Juan
350490021	65.0	61.2	61.0	-0.2	Santa Fe Airport	Santa Fe
350610008	66.7	62.6	62.3	-0.3	Los Lunas (Los Lentes)	Valencia

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* Carlsbad Caverns NP only has data for 2016-2018

2028 OZONE DVF SENSITIVITY TO DVC USING $DV_{2017-2019}$

- Six monitoring sites have $DV_{2017-2019}$ greater than the 2015 ozone NAAQS:
  - Carlsbad = 79.0 ppb
  - Desert View = 77.0 ppb
  - Santa Teresa = 76.0 ppb
  - Chaparral = 73.0 ppb
  - Hobbs = 71.0 ppb
  - Foothills = 71.0 ppb
- 2028 Base Case two sites DVF > NAAQS:
  - Carlsbad = 76.4 ppb
  - Desert View = 71.6 ppb
- 2028 O&G Control, both DVF > NAAQS:
  - Carlsbad = 76.0 ppb
  - Desert View = 71.4 ppb

AQS_ID	2017-19	Projected 2028 DVF			Site Name	County
	DVC (ppb)	Base (ppb)	Cntl (ppb)	Cntl - Base		
350010023	70.0	64.3	64.0	-0.3	Del Norte HS	Bernalillo
350010029	67.0	61.9	61.4	-0.5	South Valley	Bernalillo
350011012	71.0	64.5	64.2	-0.3	Foothills	Bernalillo
350130008	70.0	63.3	63.2	-0.1	La Union	Dona Ana
350130020	73.0	67.8	67.8	0.0	Chaparral	Dona Ana
350130021	77.0	71.6	71.4	-0.2	Desert View	Dona Ana
350130022	76.0	70.5	70.3	-0.2	Santa Teresa	Dona Ana
350130023	70.0	65.0	64.8	-0.2	Solano	Dona Ana
350151005	79.0	76.4	76.0	-0.4	Carlsbad	Eddy
350250008	71.0	68.9	68.1	-0.8	Hobbs Jefferson	Lea
350390026	67.0	63.6	62.8	-0.8	Coyote Ranger Dist	Rio Arriba
350431001	68.0	62.1	61.8	-0.3	Bernalillo (E Avenida)	Sandoval
350450009	68.0	64.6	63.7	-0.9	Bloomfield	San Juan
350450018	69.0	66.7	65.2	-1.5	Navajo Lake	San Juan
350451005	69.0	65.8	64.5	-1.3	Substation	San Juan
350490021	66.0	62.2	62.0	-0.2	Santa Fe Airport	Santa Fe
350610008	68.0	63.8	63.5	-0.3	Los Lunas (Los Lentes)	Valencia

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PRELIMINARY DRAFT AQTSD

1. Introduction
2. 2014 WRF Meteorological Modeling
3. Boundary Condition Inputs
4. 2014 Emission Inputs
5. Diagnostic Sensitivity Tests
6. 2014 Base Case Modeling and Model Performance Evaluation
7. 2028 Base Case Modeling and Ozone Design Value Projections
8. 2028 Oil and Gas Control Strategy Modeling and Ozone Design Value Projections
9. Sensitivity of 2028 Ozone Design Value Projections to Current Year Design Values
10. Summary and Conclusions
11. References

To Come:

10. APCA Source Sector Ozone Source Apportionment Modeling
11. OSAT VOC/NOx Sensitivity Ozone Source Apportionment Modeling

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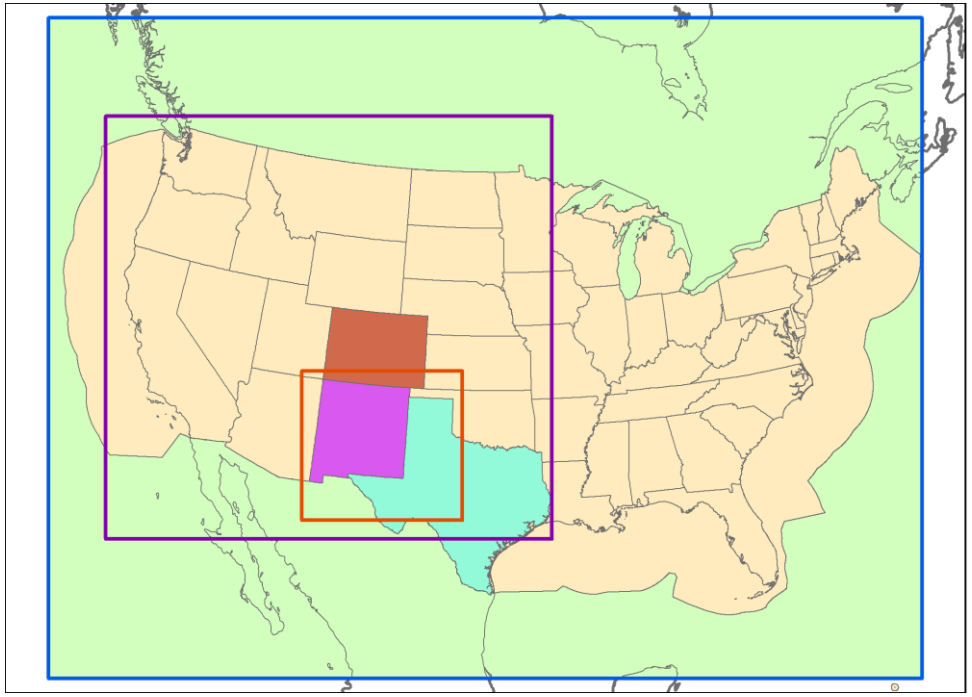
CAMX 2028 O&G CS APCA OZONE SOURCE APPORTIONMENT

- **Definition of Source Groups**
  - Boundary Conditions (BCs) from 2014 GEOS-Chem runs:
    - BC_{Intl} - International anthropogenic emissions
    - BC_{USA} – U.S. anthropogenic emissions
    - $BC_{Natural}$ – Natural sources
    - BC_{Top} – BC above the top of domain
  - Source Categories (9):
    1. Natural (biogenic, lightning NOx, etc.);
    2. Fires (WF, Rx, Ag, other);
    3. Oil and gas point sources (surrogate for midstream);
    4. Oil and gas non-point sources (surrogate for upstream;
    5. EGU point;
    6. Non-EGU point;
    7. On-road mobile;
    8. Non-road mobile; and
    9. Remainder anthropogenic.
  - Source Regions (5):
    - New Mexico
    - Texas
    - Colorado
    - Remainder U.S.
    - International (Mex, Can, CMV > 200 nmi)
  - 50 Source Groups (50 = 5 x 9 + 5)



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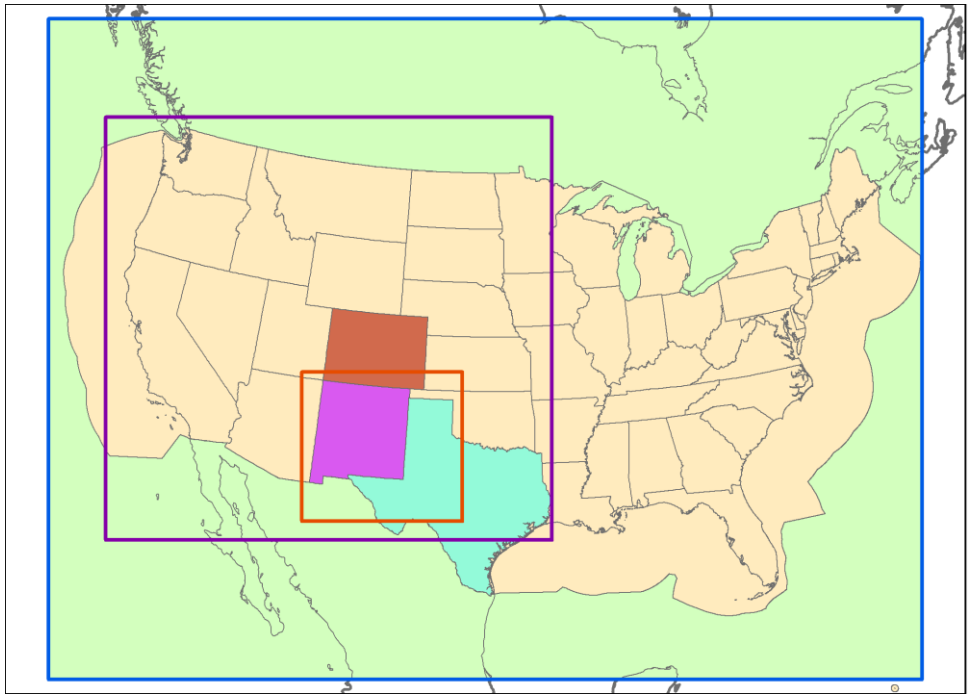
CAMX 2028 O&G CS OSAT OZONE SOURCE APPORTIONMENT

- Use the OSAT version of CAMx ozone source apportionment tool
  - OSAT O3V and O3N tracers give indication of amount of VOC-limited and NOx-limited ozone formation
- Definition of Source Groups
  - Source Regions (5):
    - Use same 5 Source Regions as APCA SA run
  - Source Categories (3):
    - Anthropogenic Emissions
    - Natural (Biogenic, lightning NOx, WBD, oceanic)
    - Fires (WF, Rx, Ag and other)
  - 17 Source Groups (5 x 3 + 2 [IC,BC])
    - Will run faster than CAMx APCA SA Run (50 Source Groups)



Start March 12, 2021

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